



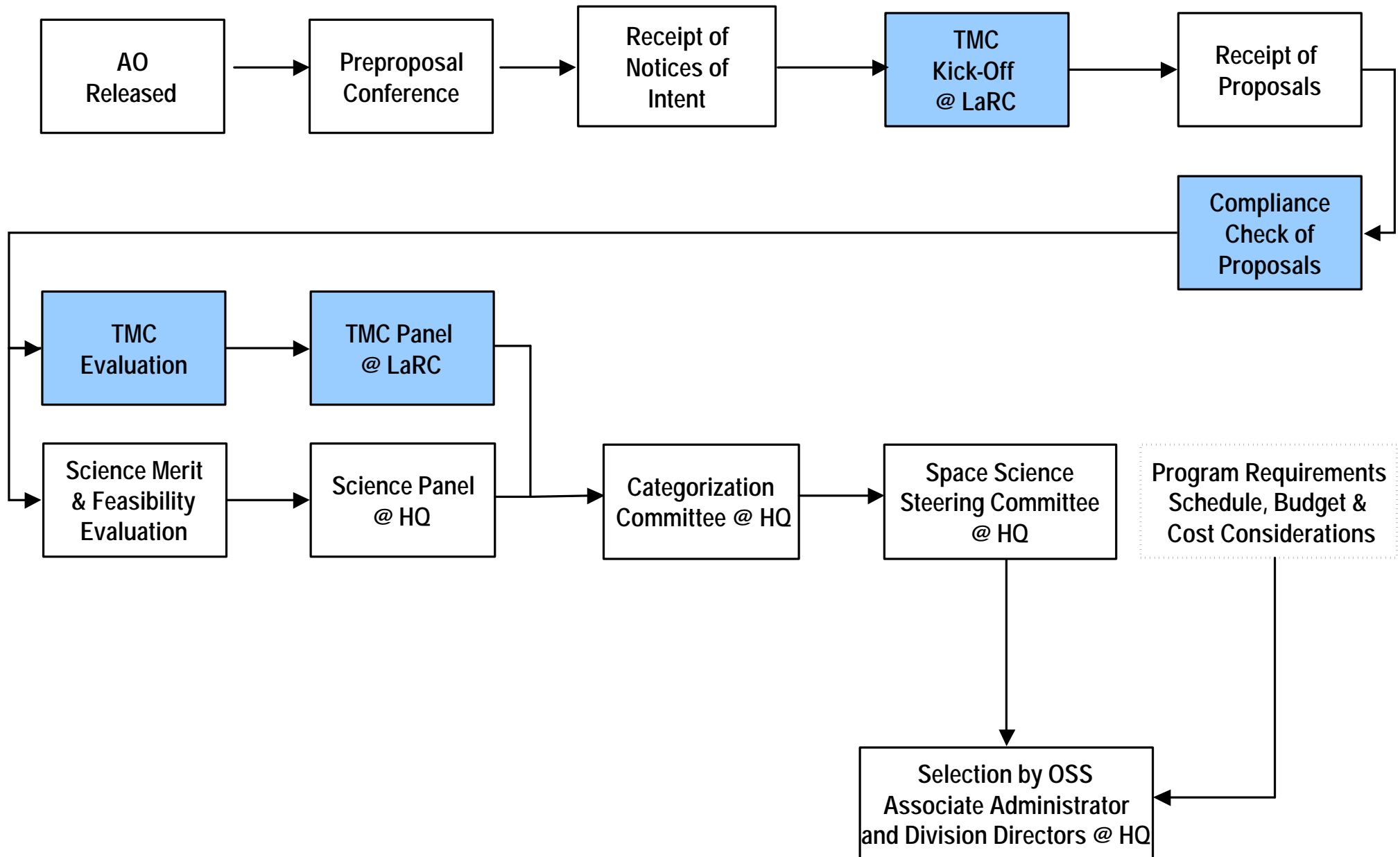
# Technical, Management, and Cost (TMC) Evaluation Plans for New Frontiers

July 23, 2002

R. Brad Perry

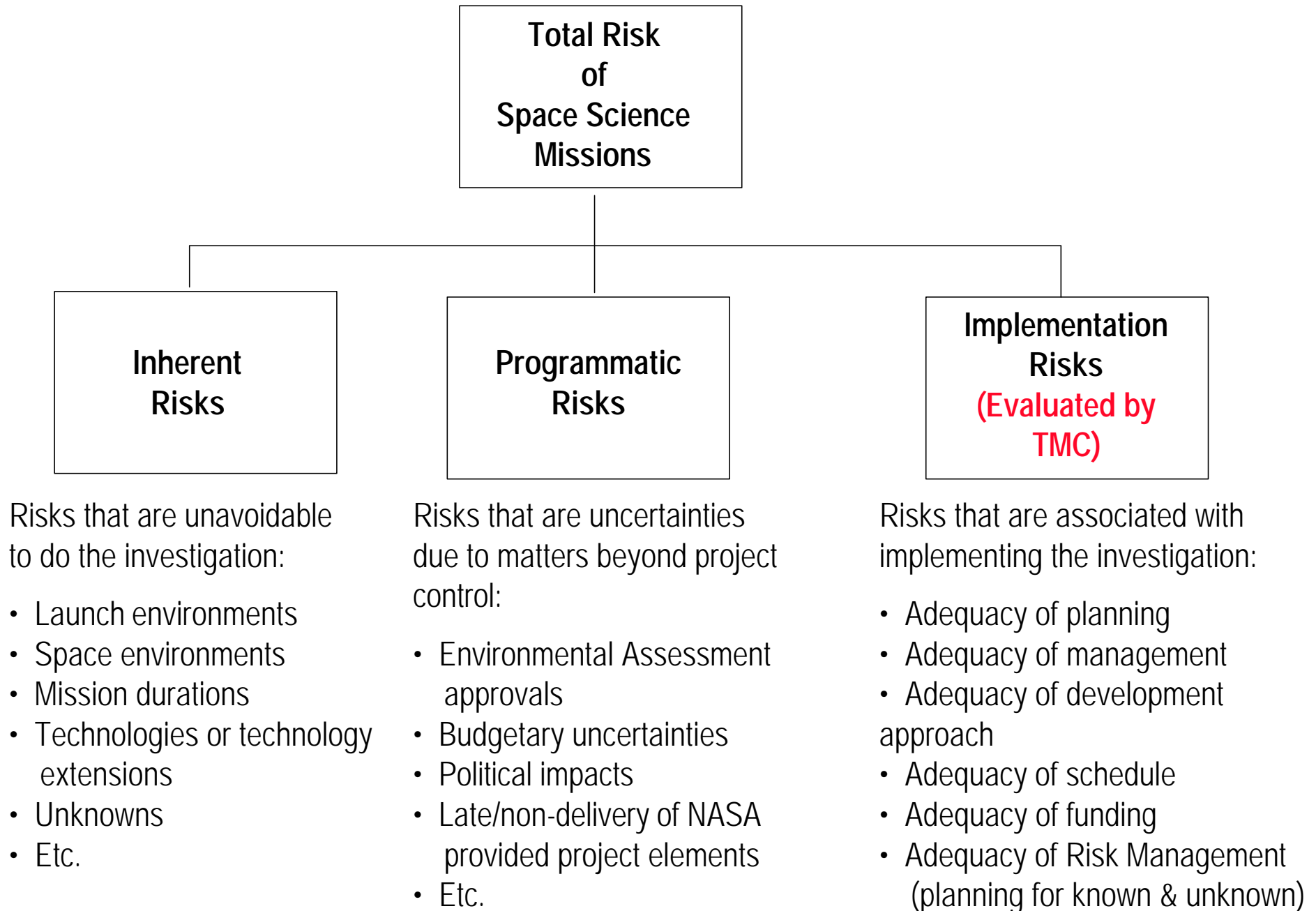


# Proposal Evaluation & Selection Process (TMC Areas Highlighted)





# Risks for Space Science Missions





# New Frontiers Defined from a TMC Perspective

- The Technical, Management, and Cost (TMC) Evaluation Process will be structured very similarly to that for Discovery.
- **Selection (Phase One) Proposal Risk Assessment:**
  - The Phase One Selection is based primarily on Science.
  - The TMC Risk Assessment is based on a *preliminary concept* with appropriate benefit of the doubt given to the Proposer.
  - The Cost Analysis is done without Proposer feedback and is integrated into overall risk.
  - High Risk Proposals will not be selected; however, Medium and Low Risk Proposals may be selected if the Science is compelling.
- Mission of Opportunity (MOO) investigations will be evaluated using same criteria as full mission investigations.
- Quality of Plans for Education & Public Outreach, Technology Infusion & Transfer, and Small Disadvantaged Business Subcontracting are NOT Evaluated in the Selection Phase. However, inclusion of these factors into the Proposal will be Compliance Checked.



# TMC Principles for New Frontiers

- **Basic Assumption:** Proposer is the expert on his/her proposal.
  - **TMC:** Task is to try to validate proposer's assertion of Low Risk.
  - **Proposer:** Task is to provide evidence that the project is Low Risk.
- **All Proposals will be reviewed to identical standards.**
  - ESSSO established in 1996 by OSS to support Discovery and Explorer, but now also supports New Frontiers, OES, and others.
  - The TMC process is used by ESSSO to support all OSS evaluations with a standard process.
  - Evaluation Plan approved by NASA Headquarters and in place before proposals arrive.
  - All proposals receive same evaluation treatment in all areas and by all reviewers.
- **All evaluators will be experts in the area of expertise that they evaluate.**
- **TMC Findings will be the consensus of the entire TMC panel.**
  - Findings: As expected (no finding), above expectations (strengths), below expectations (weaknesses).



# TMC Risk Ratings

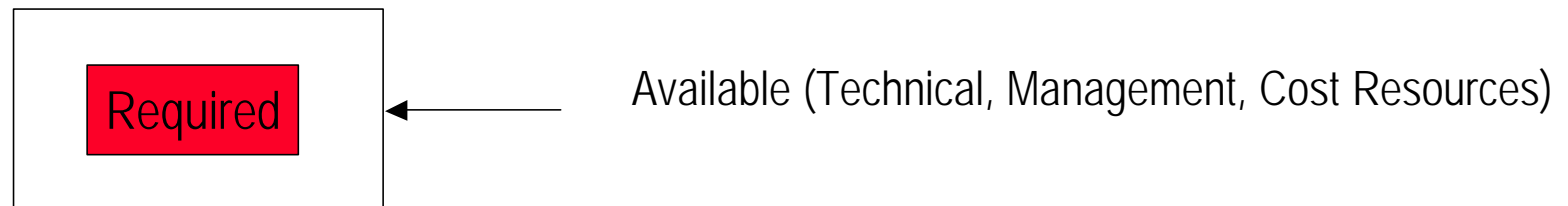
- The TMC evaluation is to determine, for each Proposal, the level of risk of accomplishing the scientific objectives of the investigation, as proposed, on time and within cost.
- There are three possible Risk Levels: Low, Medium, and High
  - **Low Risk:** There are no problems in the proposal that cannot be normally solved within the time and cost proposed. Problems are not of sufficient magnitude to doubt the Proposer's capability to accomplish the investigation. **"Envelope more than adequate"**
  - **Medium Risk:** Problems have been identified, but are considered within the proposal team's capabilities to correct with good management and application of effective engineering resources. Technology may not be ready, but available time and money should get it there. Mission design may be complex and resources tight. **"Envelope adequate but tight"**
  - **High Risk:** Problems are of sufficient magnitude such that failure is highly probable. **"Envelope inadequate"**



# TMC Envelope Concept

**Envelope:** All TMC Resources available to handle known and unknown development problem that occur. Includes schedule and funding reserves; reserves and margins on physical resources such as mass, power, and data; descope options; fallback plans; and personnel.

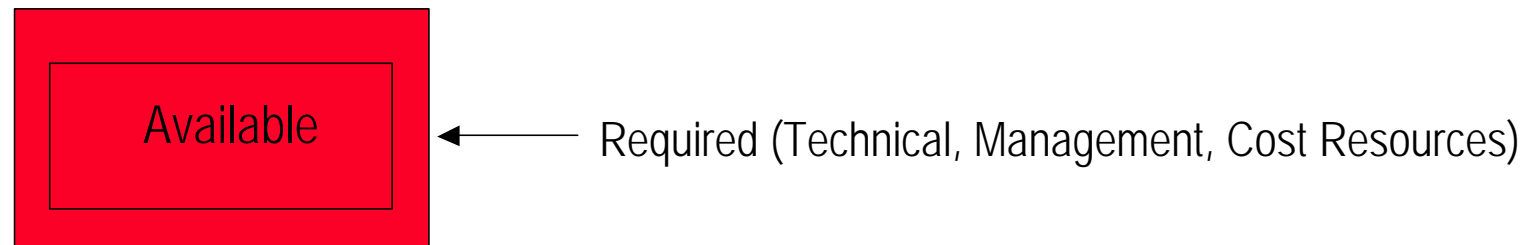
**Low Risk:** Required resources fit well within available resources



**Medium Risk:** Required resources just barely inside available resources. Tight, but likely doable



**High Risk:** Required resources DO NOT fit inside available resources. Expect project to fail





# TMC Key Technical Definitions

- **Contingency (or Reserve):** When added to a resource, results in the maximum expected value for that resource. Percent contingency is the proposed value of the contingency divided by the maximum expected value of the resource minus the contingency.
- **Margin:** The difference between the maximum possible value of a resource (the physical limit or the agreed-to limit) and the maximum expected value for a resource. Percent margin for a resource is the margin divided by the maximum possible value minus the margin.
- **Example 1:** A payload in the design phase has an estimated mass of 115 kg including a proposed mass reserve of 15 kg. There is no other payload on the ELV and the ELV provider plans to allot to you the full capability of the vehicle, if needed. The ELV capability is 200 kg. The mass reserve is  $15/100 = 15\%$  and the mass margin is 85 kg or  $85/115 = 74\%$
- **Example 2:** The end-of-mission life capability of a spacecraft power system is 200 watts. Your instrument is expected to use 50 watts, including 25% contingency. You are allotted 75 watts by the satellite provider. Your reserve is 10 watts and your margin is 25 watts, or  $25/50 = 50\%$



# TMC Evaluation Considerations for New Frontiers Mission Investigation Proposals



Generally, the degree to which Proposals address the following factors directly relates to the grade of Low, Medium, or High Risk:

- **Mission Design and Launch Vehicle**
  - Launch Mass Margin
  - Trajectory Analysis
  - Launch Services
- **Flight System**
  - Hardware/Software Design
  - Design Heritage
  - Systems Engineering
  - Design Margins (Excluding Launch mass)
  - Qualification & Verification
  - Instrument accommodations and resources
- **Ground System**
  - Concept of Operations
  - Team Experience
  - Ground Facilities – New/Existing
  - Telecom
- **Management, Organization, and Schedule**
  - Roles & Responsibilities
  - Organizational Structure & Work Breakdown Schedule (WBS)
  - Risk Management, Including Descope Plan & Decision Milestones
  - Project-level Schedule
- **Cost**
  - Basis of Estimate (BOE)
  - Cost Realism & Completeness
  - Cost Reserves by Phase
  - Comparison with TMC Estimates (Including Parametric Models/Analogies)

# Some Characteristics Applicable to a Low Risk Rating



- All risks for the project have been/are being identified and managed by the team, with plans to reduce or retire the risk before launch.
- No risk exists for which there is neither a workaround planned, nor a very sound plan to develop and qualify the risk item for flight.
- The proposed project team and each of its critical participants are competent, qualified, and committed to execute the project.
- The project will be self managed to a successful conclusion while providing reasonable visibility to NASA for oversight.
- The team has thoroughly analyzed all project requirements, and the resulting resources proposed are adequate to cover the projected needs, including an additional percentage for growth during the design and development, and then a margin on top of that for unforeseen difficulties.
- Reserve time exists in the schedule to find and fix problems if things do not go according to plan.
- Any contributed assets for the project are backed by letters of commitment.
- The team understands the seriousness of failing to meet technical, schedule, or cost commitments for the project in today's environment.



# Typical TMC Evaluation Questions to be Answered

- Will overall mission/project design (spacecraft, launch vehicle, ground system, mission operations) allow successful implementation of investigation as proposed? If not, are there sufficient resources (time & \$) to correct identified problems?
- Does proposed design/development allow the investigation to have a reasonable probability of accomplishing its objectives and include all needed tools? Does it depend on new technology that has not yet been demonstrated? Are requirements within existing capabilities or are advances required? Does the Proposal accommodate sufficient resiliency in appropriate resources (e.g., money, mass, power) to accommodate development uncertainties?
- Is there a Risk Management approach adequate to identify problems with sufficient warning to allow for mitigation without impacting the investigation objectives? Does Proposer understand proposal risks and are there adequate fallback plans to mitigate them, including risk of using new technology, to assure that the investigation can be completed as proposed?



# Typical TMC Evaluation

## Questions to be Answered (concluded)

- Is the schedule doable? Does it reveal an understanding of the work to be done and the time it takes to do it? Is there a reasonable probability of launching on time? Does it include schedule margin?
- Will proposed management approach (e.g., institutions and personnel, as known, organization, roles and responsibilities, experience, commitment, performance measurement tools, decision process, etc.) allow successful completion of the investigation? Is the PI in charge?
- Does the investigation, as proposed, have a reasonable chance of being accomplished within proposed cost? Are proposed costs within appropriate caps and does cost estimate cover all costs including full-cost accounting for NASA Centers? Are costs phased reasonably? Is there evidence in the Proposal to give confidence in the proposed cost? Does the Proposer recognize all potential risks/threats for additional costs or cost growth (e.g., added costs of utilizing the Space Shuttle, failed developments, etc.)?